

ABSTRACT

Metal dusting (MD) is a severe form of corrosion in which iron, steels, and nickel (Ni) and cobalt (Co) based alloys disintegrate into a metal or carbide powder with a coke deposit when exposed to strongly carburising gases (carbon activity, $a_c > 1$) at elevated temperatures (400-800°C). Temperature affects both the driving force and rate of the reaction, represented by gas phase supersaturation with carbon, and the rates of the various processes involved in converting that energy difference into the dusting process. Therefore, process streams such as reformer gas can be benign when hot, but becomes aggressive below critical temperatures. There are different views in literature about the effect of temperature on metal dusting of different materials and alloys.

Alloy 800 experiences metal dusting (MD) at 525°C, which is the temperature of the tube sheet of reformers in petrochemical industry. This alloy is specifically used for tube ferrules in the reformers. The reformer trains can reach a critical (highest) internal temperature of 650°C. Therefore, these two temperatures were compared. The effect of temperature and exposure time on the metal dusting of Alloy 800 were investigated in terms of the form of attack and the degradation mechanism. From the results obtained, it was observed that the longer exposure periods result in more carbon deposition and the carbon filaments in the coke become finer as compared to the nanotubes obtained after shorter exposure periods. The alloy suffered metal dusting attack after a relatively short exposure period of three days (72 hours) at both temperatures of 525°C and 650°C, with very little coking.